COSMOS CHEMICAL

PCM De-icing additive

Contents

cosmos Chemical

1. About Us

PCM (Phase Change Material)

(Standard factory in Gimje Free Trade Zone, Jeonbuk Special Self-Governing Province, Republic of Korea D-building)

"ABOUT US

In the spirit of an inventor, we developed road safety facilities and construction technology based on field experience. Established in 2024, Cosmos Chemical is a specialized manufacturer of anti-slip and De-icing paving materials using MMA resin.

In particular, technologies that include De-icing functions in anti-slip paving materials and spray-type materials are urban engineering technologies that can drastically reduce accidents caused by black ice road in winter.

With the management philosophy of differentiated technology, technology sharing, and shared value realization, we launch new products domestically and internationally through creative innovation through constant challenge and continuous growth. We promise to become a company that spreads value and technology. Thank you.

All staff members

2. Phase Change Materials Overview

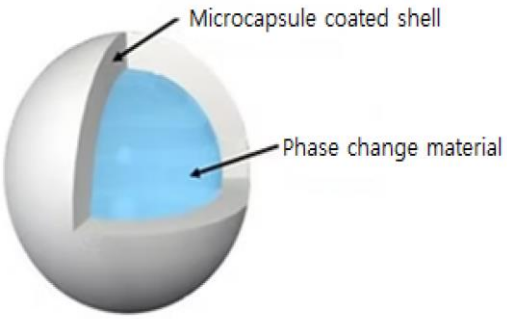
PCM (Phase Change Material) Energy storage stage change form

- Solid-liquid phase change materials have the advantage of large latent heat of phase change.
- Advances in energy storage technology through the development of phase change materials.

2-1. PCM (Phase Chang Material)

Innovative PCM (Phase Chang Material) technology

Energy storage step change materials



Energy storage phase change materials have the advantages of high energy storage density, small temperature change in the heat absorption and release process, and easy process control.

Energy storage PCMs have the ability to change their physical state and absorb or release latent heat within a certain temperature range.

For example, if we take a solid-liquid phase change, when heated to its melting point, the phase change material absorbs and stores a large amount of energy during the melting process.

When cooled to its freezing point, the PCM releases latent heat during the solidification process. The energy storage phase change material should have the following properties:

When cooled to its freezing point, the PCM releases latent heat during the solidification process. The energy storage phase change material should have the following properties:

3. Anti-freezing additive (PCM)

Phase Change Material- 3 types of PCM

MOSTONE ASP-PCM (Anti-freezing additive)	MOSTONE F-PCM (Anti-freezing additive)	MOSTONE PCM-B-1 (Anti-freezing additive)
ASP-PCM, an anti-freezing additive with freezing point depressing properties that can be mixed into anti-slip packaging materials, is a chloride PCM that is dissolved into the surface of anti-slip packaging materials to lower the freezing point.	F-PCM, an anti-freezing additive with freezing point depression properties that can be mixed into anti-slip packaging materials, is a sulfate-based, paraffin-based PCM that is insoluble in water and plays a role in increasing the flexibility and hardness of the coating.	PCM-B-1, an anti-freeze additive with freezing point depression properties that can be mixed into anti-slip packaging materials, is an inorganic alcohol PCM that acts as a low-temperature, low-fragrance agent.
		

3 types of PCM heat energy storage MMA anti-slip packaging material is applied 3 to 5 mm on the existing pavement surface to provide maximum protection in winter.

This is a method that can prevent slipping accidents caused by thin road ice down to -16 degrees Celsius.

4. COSMOS flagship product

MOSTONE Series (Anti-freezing additive)

Product Description and Price

Product name	Product photo	Specifications
MOSTONE-100 Anti-slip paving materials including anti-icing		price: 120,000원 specs: 25kg MMA anti-slip paving material containing anti-icing additives
MOSTONE-200 Covering materials including anti-freeze		price: 130,000원 specs: 25kg MMA film-type packaging material containing anti-icing additives
PCM-AS 1 Anti-freezing additive		price: 12,000원 specs: 2.5kg Anti-freeze additive (for field mixing)

4-1. COSMOS flagship product

Creation of innovative technologies (MOSTONE-100)

MOSTONE-100 Product description

- MOSTONE-100 is an anti-slip packaging material containing anti-icing additives.
- MOSTONE-100 anti-slip paving material including anti-freeze can be applied to existing paving surfaces to prevent freezing accidents caused by black ice that occurs in winter at temperatures as low as -16 degrees celsius.

4-2. COSMOS flagship product

Creation of innovative technologies (MOSTONE-200)

MOSTONE-200 Product description

- MOSTONE-200 is a film-type floor covering containing anti-icing additives.
- MOSTONE-200 anti-freeze coating flooring can be applied to existing pavement blocks to prevent freezing accidents caused by black ice that occurs in temperatures as low as -16 degrees celsius in winter.

4-3. COSMOS flagship product

Creation of innovative technologies (Anti-freezing additive PCM-AS1)

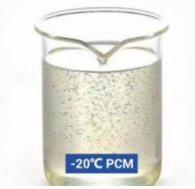
PCM-AS1 Product description

- PCM-AS1 is a mixture of chloride-based & De-icing rock salt & special materials to improve anti-icing performance.
- PCM-AS1 is an anti-icing treatment that is mixed directly into the paint at the job site.
- Since PCM-AS1 has a hardening function, it is used mixed with a hardener (BPO).

5. Phase change material with freezing point strengthening properties(PCM)

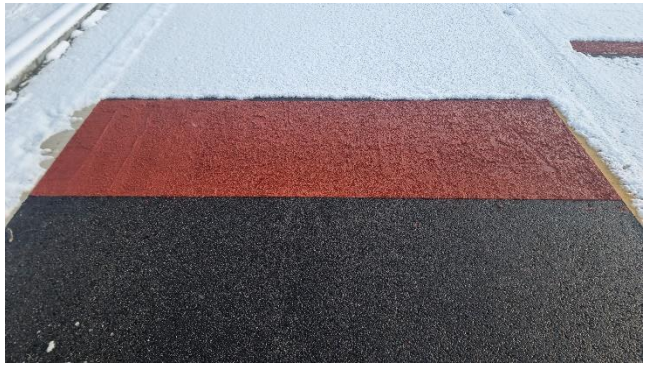
Anti-slip paving material mixed with anti-icing additives

For road PCM (Prevents road ice and snow compaction on winter roads with anti-icing additives that suppress freezing on road surfaces)



6. Installation Cases (Our test roads)

Installation photo of anti-slip paving material mixed with anti-icing



6-1. Installation Cases (Our test roads)

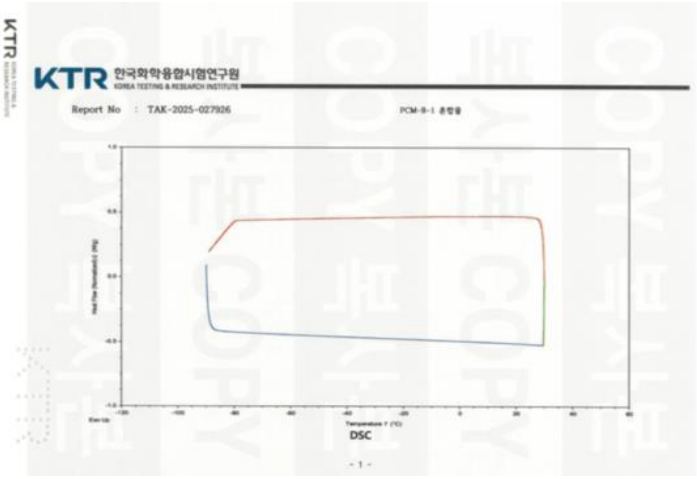
Thawing process after vehicle passage



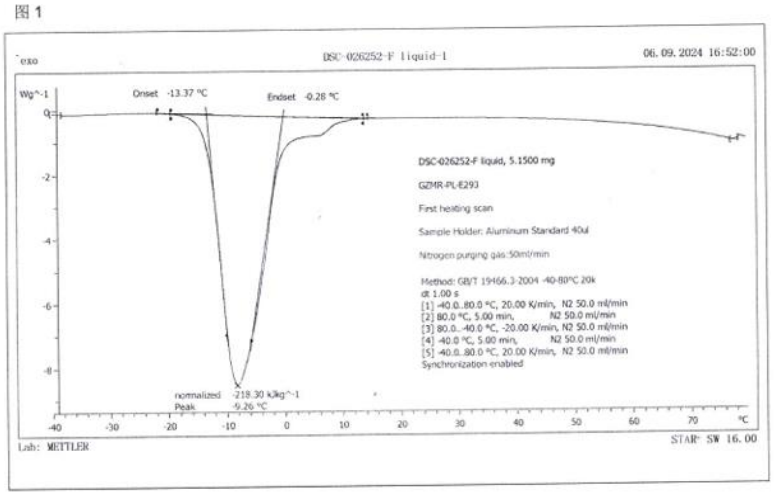

7. Technical Mechanism

Freezing temperature peak test

Korea Convergence Chemical Testing and Research Institute(KTR)



China Chemical Testing and Research Institute



Phase change material (PCM B-1) Freezing temperature peak test

- Peak – 90 ℃
- The freezing temperature of the phase change material before mixing MMA paint was measured, and freezing was prevented up to -16℃ after mixing with the paint.

Phase change material (ASP-PCM) Freezing temperature peak test

- Peak – 9.26 ℃
- The freezing temperature of the phase change material before mixing MMA paint was measured, and the phase change temperature was designed to react at 0℃ so that it could be dissolved on the ASP-PCM coating surface.

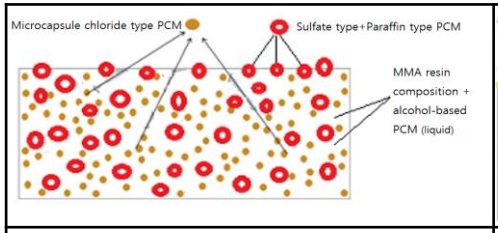
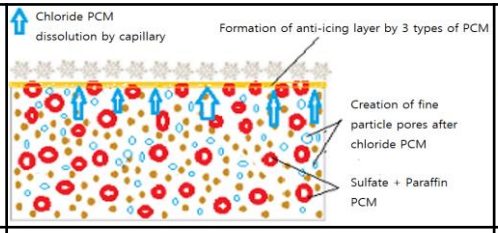
7-1. Technical Mechanism

Creation of innovative PCM cutting-edge encapsulation technology

PCM for road use (anti-icing)

- **Mechanism**

Anti-freezing principle of three types of PCM (phase change material) additives in MMA resin composition

		
Phase change material particle distribution: (A) chloride system, (B) sulfate system + paraffin system (1.2 mm or less), (C) alcohol system	After dissolution of chloride PCM by capillary action, insoluble sulfate-based + paraffin-based PCM fills the fine particle pores from solid to liquid again and changes to solid to perform anti-freezing function.	It performs the anti-freezing function by changing from solid to liquid at a phase transition temperature of 0 degrees Celsius and by capillary phenomenon due to frictional force of vehicle load wheels.

Patent application

- PCM anti-icing additive for anti-slip packaging, manufacturing method and construction method
- PCM anti-icing agent for road paving, manufacturing method and construction method

7-2. Technical Mechanism

Technology principles of anti-slip paving materials including anti-icing

Description of technical principles

1) It acts to lower the freezing temperature by the third-party chloride injection. However, the chloride from the vehicle wheels is lost or the salt dissolved by melting snow and ice is discharged into the sewer.

2) To solve the above problems, insoluble sulfide PCM and paraffin PCM are mixed to maintain long-term antifreeze properties.

3) Insoluble PCM can maintain phase change performance for a long time because it does not dissolve in water. Therefore, chloride-based PCM is eluted to generate fine particle pores, and in the generated fine particle pores, sulfide-based PCM and paraffin-based PCM that are not dissolved in water with a size of 1.2 mm or less undergo phase change from solid to liquid and settle in the fine particle pores.

4) By adjusting the phase change temperature of sulfide PCM and paraffin PCM lower than that of chloride PCM, the liquid can be re-settled in the fine particle pores created by the dissolution of chloride PCM.

5) Even if the chloride-based PCM is continuously dissolved and lost, the sulfide-based PCM and paraffin-based PCM can fill the gap, thereby maintaining anti-freezing properties again.

6) The freezing prevention temperature can be as low as -16 degrees, but the freezing prevention temperature will decrease over time as the dissolved chloride PCM is lost.

7) Compared to other companies' products, the black ice phenomenon can be minimized at temperatures above -5 degrees Celsius, and traffic accidents can be reduced with sufficient ice prevention in shaded areas and mountainous areas.

8. Development background and necessity

▶ Development Background

1. The Ministry of Trade, Industry and Energy is developing phase change materials through industry-academia-research collaboration and is at the research stage.
   Our company has developed a phase change material with anti-freezing function that can be mixed into anti-slip packaging materials through a technical partnership with China Ice and Ice Company, and is in the commercialization stage.
2. We have delivered samples of anti-freezing additive phase change material to about 10 domestic paint companies, and are conducting research on mixing ratios. Our goal is to form a technical partnership with a company that develops and manufactures optimal product properties.

▶ Necessity

1. According to the Ministry of Public Administration and Security, 3,944 road icing accidents occurred between 2019 and 2023, resulting in 95 deaths and 6,589 injuries. According to the above statistics, approximately 20 deaths occur each year. If anti-slip paving materials mixed with anti-icing additives are installed on roads, the number of deaths can be reduced by up to 50%.
2. In particular, ASP-PCM, an anti-freeze additive with freezing point lowering properties that can be mixed into our anti-slip paving materials, is a technology that can definitely melt black ice in black ice sections, and it is dissolved on the surface of the anti-slip paving materials to lower the freezing point, thereby reducing accidents.

9. Target Market and Commercialization Strategy

Current status and plans for entry into domestic and foreign target markets

List of anti-slip paving contractors

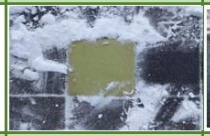
By region	gyeonggi-do	Gyeongsang buk-do	Jeollabuk-do	Gyeongsang nam-do	Chungcheon gnam-do	Gangwon-do	Jeollanam-do	busan	Sejong City
Number of company registrations	102	34	25	30	24	28	25	20	2
By region	Chungcheon gbuk-do	Incheon	Daejeon	seoul	Ulsan	daegu	gwangju	jeju island	
Number of company registrations	24	16	11	11	8	4	2	10	

- The number of domestic procurement registered companies was surveyed at 375, and in terms of regional distribution, about 100 companies were registered in Gyeonggi-do. Currently, 10 companies are surveyed that are developing or selling anti-slip paving materials with anti-icing functions.
- In particular, Jeonbuk Special Self-Governing Province enterprise Jeongseok Chemical produces anti-slip paving materials with anti-freezing functions, and in the Gyeonggi region, Juwon Gongyeong, Green I-Coat, and Do Kyung Construction produce products with anti-freezing functions using chloride.
- It was found that the anti-icing function of chloride-based products manufactured by third parties significantly decreases after the summer rainy season passes, and thus the anti-icing effect is not achieved..

9-1. Target Market and Commercialization Strategy

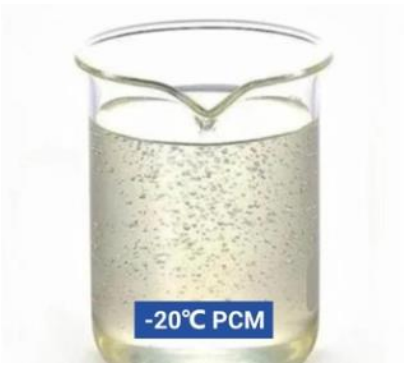
Product differentiation

Road ice prevention facility comparison analysis table

assortment	Anti-freeze additive mix Film type flooring (our company)	Anti-freeze additive mix Anti-slip packaging material (our company)	Anti-icing surface treatment agent (Samjung C&M Tech)	Anti-freezing Anti-slip paving material (Samsin Enterprise)	Anti-freezing Anti-slip paving material (Juwon Gongyeong)	Hot wire packaging	salt water spray device
Product photo							
Anti-ice effect	16 degrees below zero	16 degrees below zero	10 degrees below zero	6 degrees below zero	6 degrees below zero	Depending on the electric heating capacity	6 degrees (depending on salt density)
Price comparison	$28.21(3T)	$31.74(4T)	$25.39(4T)	$30.32(5T)	$26.79(4T)	$987.10(㎡)	$352.53(㎡)
Road ice prevention	○	○	○	○	○	x	x
Whether the existing packaging is damaged	x	x	x	x	x	○	○
Installation and maintenance costs	None after initial construction	None after initial construction	None after initial construction	None after initial construction	None after initial construction	Very high	high
Constructability	Very easy	Very easy	Very easy	Very easy	Very easy	difficulty	difficulty
How to install	Application on existing packaging surface	Application on existing packaging surface	Application on existing packaging surface	Application on existing packaging surface	Application on existing packaging surface	Bury after cutting the existing packaging	Installation of salt water spray device
Field applicability	All sites	All sites	All sites	All sites	All sites	Electricity supply is required	Brine storage tank installation required

10. Phase change material PCM main business area

Scalability: Microcapsule PCM (Step Change) Applications

Moston Anti-Freeze Additive	PCM-B-1	For road use ASP-PCM	For concrete PCM
			

cosmos
Chemical

“History has always found its own way, and we make that way.”

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